Consultative Group on International Agricultural Research

Mailing Address: 1818 H Street, N.W., Washington, D.C. 20433, U.S.A.
Office Location: 701 18th Street, N.W.
Telephone (Area Code 202) 473-8915
Cable Address-INTBAFRAD
Fax (Area Code 202) 473-8110

From: The Secretariat

May 11, 1994
MT/94/06

Mid-Term Meeting, May 23-27, 1994
New Delhi, India

Follow-Up to UNCED/Agenda 21
Progress Report by the CGIAR Task Force

A CGIAR Task Force was established at MTM93 to sharpen the CGIAR response to Agenda 21. The attached report details the status of work by the Task Force in developing proposals on seven priority themes relating to marginal and degraded lands, integrated pest management, in situ conservation of genetic resources, and conservation of the biodiversity of tropical forest ecosystems.

At MTM, the Task Force will seek the Group's response to its work to date and will seek guidance on implementing the action plans recommended by the Task Force.

An IBSRAM report entitled "Soil, Water, and Nutrient Management Research, A New Agenda" will be discussed in conjunction with the report of the Task Force.

Attachment

Distribution

CGIAR Members
Center Board Chairs
Center Directors
TAC Chair
TAC Secretariat

CONTENTS

CGIAR FOLLOW-UP TO UNCED's AGENDA 21

I. INTRODUCTION

Asked by ICW93 to continue its work on suggestions for a suitable response by the CGIAR system to the challenges in Agenda 21, the Task Force hereby presents its report. The Task Force has consisted of Stein W. Bie (NORAGRIC, Norway, chair), Iain MacGillivray (CIDA, Canada), Pedro Sanchez (ICRAF), Hubert Zandstra (CIP) and Carlos Zulberti (UNEP). During the preparation of the report members of the Task Force has interacted with CGIAR centres, donors to the CGIAR system, and the CGIAR Secretariat, as well as other working groups within and outside the CGIAR system. Particular mention should be made of the IPM Working Group and IBSRAM. Financial support has been received from the Norwegian Ministry of Foreign Affairs.

The report is presented at a time of much activity among CGIAR centres individually and in consortia to identify new roles for centres and their partners in national and international research. The centres have allocated lead roles on a variety of topics to individual centres. The input from lead centres has played a major role in the finalization of this report. The CGIAR centres have also launched other initiatives that may usefully be seen as individual responses to Agenda 21. The present Task Force report formalizes outlines for a series of **CGIAR system responses** discussed with centres and donors during ICW92, MTM93 and ICW93.

II. OBJECTIVES

The CGIAR recognizes that it has an obligation as a research system to respond to the calls of action contained in the Rio Declaration and in Agenda 21. Each individual CGIAR centre acknowledges that it is expected to forward new ideas on how its specific expertise may be employed for implementation of some of the relevant issues outlined in Agenda 21. This expectation is present among all stakeholders in the CGIAR system.

The CGIAR system is already involved in pursuing many relevant research targets covered in the broad approach of Agenda 21. The system will continue to do so, and strive towards a wider acceptance in the donor community for the relevance of its established activities within the context of Agenda 21.

Through the expertise gained and the networks for collaboration with developing countries arising from past activities the CGIAR system, there are many opportunities for addressing new and additional topics not covered by the agreed CGIAR agenda at present. It is a reality that at times of austerity within international agricultural research, and severe financial constraints for every CGIAR

centre, the CGIAR is simply unable to undertake new and additional tasks within its present funding envelopes. To utilize the expertise resident in the CGIAR system, and to encourage further its interaction in strengthening national capabilities in the poor countries, the donor community must back its calls for Agenda 21 action with specific funds to the CGIAR targetted for CGIAR follow-up to Agenda 21.

Through a detailed analysis of the 40 chapters of Agenda 21, and a review of the expertise present in the CGIAR system, the Task Force has identified 7 topics where it feels there is a good match between the urgency for knowledge creation and knowledge sharing on the one hand and CGIAR system capability on the other. Furthermore the Task Force has identified one specific activity where ongoing initiatives will further strengthen CGIAR capability in pursuing the new topics and add to current CGIAR capability.

This "7 + 1" approach is complementary to other initiatives arising within the CGIAR community and its close associates. The Task Force notes that the CGIAR centres currently respond individually and as consortia to a wide range of topics suggested under the broad framework of Agenda 21. Agenda 21 has clearly injected new perspectives into the planning of future centres work. The Task Force suggests that in addition to these individual initiatives, which form part of a possible new focus for international research, the CGIAR system should offer the "7 + 1" approach as a system-wide response to Agenda 21.

III. TOPICS PROPOSED FOR SPECIAL CONCENTRATION OF CGIAR EFFORTS : THE 7 + 1 TOPICS - AN OVERVIEW

Over the last 18 months the Task Force and its precursors have conducted an extensive dialogue with the CGIAR stakeholders and closely associated institutions to identify those novel topics that would seem to be important in a response to Agenda 21 yet realistically be within the sphere of expertise possessed by the CGIAR system. Open dialogues have been held at ICW92, MTM93 and ICW93, resulting in the "7 +1" approach. The Task Force will present its rationale for the selection of the 7 topics.

The suggested 7 topics can be grouped into 3:

(A) MARGINAL AND DEGRADED LANDS

(With a special emphasis on those lands that are facing increasing human and/or livestock pressure):

- The Desert Margins Initiative on arid and semi-arid zone drylands
- Marginal and degraded lands caused by tropical deforestation

- Sustainable mountain agricultural development
- Agricultural and water policy to sustain the resource base and productivity growth in fertile lands
- Global long-term forestry research network

(B) CONSERVATION OF GENETIC RESOURCES

- The Biodiversity Initiative, with special focus on the in situ conservation of crop, livestock, fish and forest resources

(C) INTEGRATED PEST MANAGEMENT

- Special focus on reducing reliance on chemical pesticides in production of the major commodity food crops covered by the CGIAR system and the production systems to which they belong.

The Task Force will give an introductory assessment of the likely significance of an intensive research effort in these areas expressed in terms of:

- Possible impact on prospects for intensification and improved agricultural productivity and on human welfare.

- Avoidance of the need for mass population migration in search for alternative lands.

- Possible impact in slowing degradation of natural resources including soils, water, fishery and forest resources.

The additional topic is:

(D) THE USE OF GEOGRAPHICAL INFORMATION SYSTEMS TECHNOLOGY

The Task Force will review current efforts to establish standardised data sets on natural science variables and socio-economic variables for use in existing and future computer-based GIS. It will limit its suggestions to strategies for the selection, harmonization and standardization of such data sets, and will not consider the choice of actual hardware/software systems for data processing. The objective of this initiative is to ensure that CGIAR centres can contribute to and utilize relevant global data sets now becoming available within the UN system and the global research and planning community. The Task Force recognizes that UNEP and CGIAR have launched a separate initiative for support for such global data sets.

THE DRYLANDS INITIATIVE

Global scope of the problem

An estimated 900 million people derive their livelihoods from the drylands of the world (< 800 mm precipitation/year and precipitation: potential evapotranspiration ratios of 0.1-0.6). Drylands are most widespread in Africa and Asia, but with significant areas also in the Americas and Southern Europe. Plant production relies on rainfall that varies greatly both in time and spatial distribution. Increased population pressure on most drylands in the world has led to growing livestock numbers using limited rangeland resources, expansion of cropping into drier areas (with or without supplementary irrigation) and increasing pressure on woody biomass for fuelwood and building materials. Although many drylands display much natural resilience, there are recurrent crop failures leading to famines in poor countries, and many reports of serious local and widespread degradation of land and biodiversity.

The CGIAR has a considerable knowledge base relating to utilization and management of dryland resources, through the work of ICRISAT on crops in Asia and sub-Saharan Africa, ICARDA on crops in West Asia and North Africa, ILCA and ILRAD on animal production in Africa, CIAT on production in the Latin American drylands, ICRAF on agro-forestry techniques and IIMI on irrigation. Other centres have specialized commodity knowledge of crops grown extensively in the drylands (e.g. wheat and maize and their environments (CIMMYT), West African rice (WARDA), or production in the semi-humid parts of Africa (IITA)). Extensive collaboration with national research systems, and with international centres of excellence has placed the CGIAR IARCs in key positions in formal and informal research networks. As many dryland countries are economically poor and with small national research and extension capabilities, this internationally led research constitutes a significant part of the total global knowledge base on dryland issues. CGIAR efforts on wise utilization of the drylands, including the policy and technology transfer efforts by IFPRI and ISNAR, complements UNEP's overall surveillance of dryland resources.

UNCED's Agenda 21 in general, and Chapter 12 in particular, have led to renewed global efforts to support sustainable development of the world's drylands. An international convention, negotiated to combat desertification and the effects of drought, is expected by mid-1994, to join the conventions on climate change and biological diversity as global environmental management tools. The Desertification Convention also includes provisions for increased research efforts and technology transfer, particularly aimed at creating more sustainable land management practices for poor and vulnerable human populations.

Renewed international efforts to create sustainable livelihoods and further development through wise use of the global drylands, should be supported by making the CGIAR knowledge base, CGIAR research facilities and scientific experience, and its networks available. CGIAR's annual CGIAR investment on dryland research is approximately 300 senior scientist years (of highest international calibre). The explicit aims of Agenda 21 (especially Chapter 12) and the forthcoming Desertification Convention, on poverty alleviation, improved food security, and preservation and use of the genetic resources of dryland plants and animals, relate closely to the mandate of the CGIAR as a whole research objectives of individual IARCs working on dryland issues.

Sustainable use of the marginal and fragile drylands requires much knowledge of complex processes of interactions between natural and anthropogenic forces. Although drylands have in the past shown great ability to recover from periods of drought and human overuse, there is an increasing number of examples of seemingly more permanent loss of resilience leading to dryland degradation.

Previous research on dryland soil erosion by water and wind have either been on macro scale, or confined to small experimental plots. Extrapolation to manageable units (farms, rangeland blocks, watersheds) has proved difficult in developing countries. Time series are often short, and strongly influenced by sporadic intense droughts or downpours or severe floods. There is a need for field-scale erosion estimates for long-term management planning at national level, and quantification of the impact of soil conservation measures.

Much of the research has focussed on the negative effects of droughts and periodic overgrazing, overcultivation and overexploitation of woody species. There is a scarcity of research results relating to the recovery phase of drylands, during periods of increased precipitation or controlled management. There is a need for new research aimed at utilizing the inherent resilience in drylands to hasten and enhance the recovery process. Part of this is the documentation and development of more opportunistic production systems that acknowledge and utilize natural weather variabilities. Water harvesting techniques are relevant. Modes of development that reduce pressure on adjacent more fertile areas.

Dryland countries have experienced significant problems in irrigation management for increased agricultural production. Low-cost, robust irrigation practices need to be developed for a wide range of environments and crops (including forage crops), taking into account the absence of a technological base in many poor countries. Analytical tools designed to evaluate overall costs of proposed

irrigation schemes compared to non-irrigated production systems should be developed, particularly aiming at realistically internalizing accessory environmental costs, including water quantity and quality, and costs arising from increased health risks from waterborne diseases. There are dryland areas where poor irrigation practices have produced saline, alkaline, gypsiferous and waterlogged soils, or where agrochemicals (particularly pesticides) have accumulated. Further development of low-cost reclamation practices warrants attention, also in relation to downstream and groundwater effects.

The drylands also include the centres of origin of important crops plants of global importance (particularly cereals, but also pulses and fibre crops). Degradation of the drylands presents serious threats to the biodiversity of the landraces of these crops, and their close wild relatives. The impacts various forms of land degradation have on species diversity and genetic variability of dryland plants and animals has been poorly documented.

Research project description

The Task Force suggest using the collaborative initiative by ICRISAT, ICRAF, ILCA and UNEP (The Desert Margins Initiative) as the focus for operationalizing the CGIAR system response to Agenda 21 calls for research to combat dryland degradation. The Desert Margins Initiative is described more fully in a separate publication available from the collaborating partners, with ICRISAT as a focal point.

The aim of this initiative is to combat desertification, mitigate the effects of climatic variability, conserve biodiversity and provide improved food security by promoting innovative crop/tree/livestock production technologies. The initiative aims at linking the above centres to national research systems in Kenya, Niger, Burkina Faso, Botswana and Namibia; with additional links to India. As the initiative develops the Task Force expects other CGIAR centres (e.g. IPGRI, IFPRI, WARDA, IITA, CIFOR, ICARDA and ISNAR) and national research systems to become associated with the initiative. Other proposed collaborators include USDA-WSR, UK-NERC, CIRAD, IBSRAM, IFDC. regional research organizations within programmes operated by SADC, CILSS, IGADD, CIRDES and SPAAR, and selected NGOs representing farmers' interests. The role of this initiative in responding to the expected vision of the Desertification Convention may be significant.

The activities of this initiative fall into seven major categories:

a) characterization and analysis of land use systems
b) varietal development and adaption

c) multi-purpose forage legumes and tree selection, conservation and improvement
d) strategic research aimed at component interactions
e) development and evaluation of improved technologies
f) improved monitoring of climate
g) institution building and enhancement of human resource capacity

a) Characterization and analysis of land use systems

The research will concentrate on characterizing the biophysical and socio-economic constraints of the current land-use systems, with particular emphasis on the parkland systems, livestock feeding, and soil conservation systems. The research will review natural science variables, involve socio-economic and policy research at micro and macro levels (incl. land tenure and credit issues).

b) Varietal development and adaptation

The research will consider the value of indigenous plants and improved varieties that can ensure sustained productivity, including dual-purpose grain and forage legumes and browse species. A north-south gradient approach in the research design will ensure that contingencies are being produced for climatic change scenarios.

c) Multipurpose forage legumes and tree selection, conservation and improvement

Collection, evaluation and selection of appropriate species include studies on the reproductive biology of species, of indigenous knowledge of species and their uses, and further work on cash-producing fruit trees for small farmers.

d) Strategic research on component interactions

Competition between trees and crops for limited available water is a major concern in the drylands. Wind and water erosion issues are still poorly understood in terms of sustainable production. Efficiency of nutrient recycling through alternate use of crop and tree residues and animal manures will receive attention.

e) Development and evaluation of improved techniques

The research will focus on long term biophysical and economic impacts of alternative management strategies, including improved forecasting of rains, reduced water losses and increased water use efficiency. Both on-farm and on-station methods of experimentation will be used.

f) Improved monitoring of climate

The project will involve the standardization of weather data, and the employment of recent advances in automatic

weather stations, and include measurements on albedo, solar radiation, rainfall, temperature, humidity, wind, dust, and ground cover.

g) Institution building and enhancement of human resource capacity

National expertise is lacking, particularly in West Africa, to meet the scientific challenges that some of the scenarios of global warming suggest for the drylands. The project will aim at linking the national agricultural and meteorological research communities, to forge stronger links and to emphasize the importance of mutual dependence in addressing global warming issues.

Costs

The projects proposed under the full initiative is approx. USD 1,2 million per year over 5 years, or a total of USD 6.0 million.

MARGINAL AND DEGRADED LANDS CAUSED BY TROPICAL DEFORESTATION

Global Scope of the Problem

Fifteen million hectares of the world's remaining tropical rainforests are cut and burned every year, severely threatening biodiversity conservation and watershed stability as well as contributing 23 percent of the excess carbon emissions to our atmosphere. Approximately two-thirds of this deforestation is caused by farmers to produce food. Farmers and migrants slash and burn the forest vegetation, plant crops or pastures as long as the fertility of the soil generated by the ash lasts and weeds permit, and abandon the land to some form of fallow. Land pressures generally impede forest fallow regrowth for the 15 to 20 years needed to accumulate sufficient nutrients in the biomass. Much of the cleared land is eventually abandoned, often to coarse grasses like Imperata cylindrica which cover 40 million hectares in Southeast Asia, and degraded pastures, which cover 20 million hectares in the Amazon. Policies aimed at containing deforestation have focused primarily on macroeconomic issues and the establishment of protected areas with little attention to the human dimension. Agenda 21 changed this; in its Chapter 11 one of the priority issues in combatting deforestation is to "limit and aim to halt destructive shifting cultivation by addressing the underlying social and ecological causes".

Selection of researchable themes

In 1992, a group of NARS, NGO's and IARC's met in Rondonia, Brazil and developed the Alternatives to Slash and Burn Initiative (ASB) to tackle marginal and degraded lands caused by tropical deforestation. This section describes the salient characteristics of ASB as a direct CGIAR-led response to Agenda 21. Researchable themes were arrived at in a highly collaborative and participatory mode, involving several international centres, NARS and NGO's, conducting participatory rural appraisals in Brazil, Peru, Indonesia and Cameroon and finalizing decisions at meetings of the ASB Global Steering Group.

The overall goal of a 10 year project is to decrease deforestation by unsustainable slash and burn agriculture by providing technology and policy options that 1) greatly reduce farmers need to clear additional land 2) regenerate degraded and abandoned lands.

The approach combines:

Technology and policy dimensions, Buffer zones and degraded lands, IARC's, NARS, NGO's Strategic research, training and information, Steering groups at the local, national, regional and global levels.

Research Project Description

a) Characterization and diagnosis of farmer perceptions and policy constraints. The research agenda starts with the farmer. A new set of guidelines is being developed to ensure that such efforts are participatory, analytical and multidisciplinary.

b) Geo-referenced depictions of constraints identified by the above studies. Examples are high phosphorus fixation, high soil erosion risk, undefined land tenure and areas outside the reach of extension services.

c) Improved germplasm for soil tolerance. Selection of plants and microsymbionts aimed at increasing plant tolerance to adverse soil constraints is one of the most effective components of managing marginal soils. This involves crops, pastures and multipurpose- trees, particularly those producing high-value/low-volume commodities.

d) The strategic use of fertilizer, to supplement other sources of nutrients such as biological nitrogen fixation and organic inputs. Nutrient cycling should be maximized, paying attention to key soil processes. Nutrient budgeting can provide a practical index of sustainability: no net negative nutrient balances.

e) Biological control of soil erosion. Contour leguminous fodder hedges and vegetative filter strips transform steep slopes into level terraces in a few years, avoiding the cost of terrace construction and permitting the harvest of useful products while controlling erosion.

f) Improved systems. In the buffer zones they include managed fallows as an intermediate step between shifting and continuous cultivation; multistrata systems that initially produce annual crops but gradually become agroforests with diversified high value-low volume products; silvopastoral systems with live fence posts of leguminous fodder species and trees in pastures. In the degraded lands similar systems may take place but the level of external inputs is likely to be higher since the land is often weedy, compacted and infertile. Since most of the likely improved systems involve some sort of agroforestry, plant biodiversity is enhanced in farmers' fields as well as microbial diversity below ground.

g) Protecting the atmosphere through better land management. Sustainable agroforestry systems will decrease the demand for further deforestation, thus saving large amounts of CO2 emissions to the atmosphere. Reclaiming degraded pastures decreases nitrous oxides fluxes to the atmosphere by about half. Reclaiming degraded lands will increase carbon sequestration. These fluxes will be measured in alternative systems.

h) Policy design and implementation. Previous research components are largely technological, although they are product of extensive analysis of farmer constraints and the policy environment. Policy dialogues with national and local governmental and non-governmental institutions must take place to assure that the necessary changes are considered. Policy research issues such as strengthening institutions, marketing, land and tree tenure, crop residue management regulation and the promotion of biological terraces are likely to be part of the agenda.

i) Training and information. On the job training on new or multidisciplinary techniques such as participatory appraisal, soil carbon dynamics and marketing of non-timber forest products; linking with existing networks, and widespread communications are an essential parts of the initiative, in order for the results to bc widely disseminated in the humid tropics. Training will focus on the institutions and individuals working towards attaining the objectives of the Rio Conventions.

Anticipated Output and Impact

Initial phase outputs consists of developing multi-disciplinary teams, developing characterization guidelines and initiating field research and policy dialogues.

For the expected duration of the project, if successfully funded and executed, there will be a measurable improvement in farmer households at the forest margins, local declines in the rates of deforestation and increased acreage of reclaimed degraded lands.

In the long run, if slash and burn agriculture is reduced in half, there will be a saving of about 5 million hectares per year of tropical rainforests, with its biodiversity preserved, as well as decrease of 0.5 gigatons of C per year emitted to the atmosphere. Reclaiming degraded lands through agroforestry can sequester about 1 ton of carbon per hectare per year. Therefore ASB relates directly to the Biodiversity and Climate Change Conventions.

Participating Institutions

The first phase focuses on benchmark sites in Brazil, Indonesia and Cameroon. Subsequent phases will encompass additional sites in Peru, Thailand, Mexico, Zambia and Philippines. Benchmark sites were selected to cover a range of biophysical and socioeconomic circumstances in slash and burn agriculture. Partners in the initial phase include the NARS of the three countries involved (EMBRAPA, AARD and IRA), six CGIAR Centres (CIAT, CIFOR, ICRAF, IFPRI, IITA, IRRI), other international institutions (TSBF, IFDC) and international NGO (WRI). ASB is coordinated by ICRAF and members of the above institutions form the Global Steering Group. CIAT, IRRI and IITA are the regional coordinators

for Latin America, Southeast Asia and West Africa, respectively. The national and local steering groups, chaired by the NARS encompasses other government research and extension institutions, indigenous NGO's and universities.

Costs

The ASB initiative is funded at USD 3 million for the year 1994 by UNDP as part of the pilot phase of the GEF, under its climate change programme. The initiative was strongly endorsed by the three implementing agencies, the World Bank, UNDP and UNEP. Approximately 53% of the funds are assigned to the NARS and NGO's and 47% to the IARC'S. Cofinancing from ASB institutions, including funding from other donors is estimated to be USD 4.4 million. UNDP has suggested a second phase at about USD 5 million per year for three years. Cofinancing from other donors is needed to overcome current weaknesses in policy research, impact analysis and nutrient cycling during this second phase.

SUSTAINABLE MOUNTAIN AGRICULTURAL DEVELOPMENT

Global Scope of the Problem

World mountain ecosystems are an important natural source of water, cheap energy, minerals, forests, and biological diversity. Mountains provide a high diversity of wild species and landraces of major food crops, such as potatoes and maize, and of several less important ones. Mountains also offer sites for tourism and recreation.

Mountain resources, such as land, are highly vulnerable to human and natural interventions. Food security of mountain populations increasingly depends on the sustainable management of land resources and maintenance of biodiversity. Land productivity levels need to be preserved for generations to come. We must achieve sustainable agriculture in mountain areas where more than 80% of the currently available agricultural land is steeply sloping over a broad range of soils and patterns of climate.

The world's most important mountain biomes are located in the Andean ecoregion, the Himalayas, and Eastern Africa. They all include several developing countries with diverse policies and institutional settings. Mountain populations currently face increased poverty, unemployment, poor health and sanitation, and occasional geographical isolation. This increases the demand for food and land, which leads to farming of marginal land and inadequate management of natural resources, with corresponding negative effects: soil erosion, landslides, and loss of soil productivity, habitats, and genetic diversity.

Mountain ecosystems provide the life-support system for rural and urban populations located in lowlands. The whole Amazon basin, which supports life in its vast tropical rainforests, originates in water sources located in the Andean mountain ecoregion.

Thematic Research to Meet the Challenge

The proposed approach to conduct activities in Sustainable Mountain Development would be organized under three main thematic research areas to be pursued as cross-continental research themes:

I - Natural Resource Base
II - Policy Studies
III - Methodological Research

These would be linked to specific actions under a systems approach to particular hierarchical levels such as mountain ecosystems, countries, watersheds, and farms. Information activities and human resource development will provide support.

Research Project Description and Outputs per Theme

I - Natural Resource Base

The natural resource base theme encompasses three closely related and important research areas: biodiversity, land and water management, and commodity systems (from production to utilization).

a. Biodiversity.

Mountains, because of their myriad of altitudes, exposures, and soils, house a significant amount of biodiversity. They are also areas where agriculture practised by local ethnic groups produced many domesticates such as tubers in the Andes and maize in Mesoamerica. This rich variation has not been thoroughly tapped for biological material or indigenous knowledge.

Research in this area will include:

- Studies on native germplasm of many lesser known mountain species so as to assess their potential for product development and utilization.

- Assessment of the potential for introducing new germplasm across mountain ecosystems and their role in food security and environmental protection. This will encompass a judicious choice of crop species/varieties and their testing for local adaptation and income generation.

- In situ and ex situ conservation management in pristine, fragmented, and agricultural habitats by local communities to reduce genetic erosion. Work in this area will help develop efficient ways to interchange germplasm among mountain agroecosystems of different continents and support efforts to generate global action for the conservation of genetic diversity in mountains.

b. Land and water management.

This is the main issue affecting agricultural productivity in mountain agroecosystems. Misuse of land can result in soil erosion, loss of soil productivity, and deterioration of pasture lands. All contribute to diminishing expectations for food security. Mountains remain the natural source of a reliable water supply in many countries. Degradation of resources at the watershed level increases the variability of water regimes and sedimentation of dams and canals. These can cause a reduction in the water-generated energy supply for significant rural and urban areas.

Research in this area will attempt to:

- Understand land and water management dynamics in mountain agroecosystems.
- Preserve and increase soil productivity.
- Measure antropic, eolic, and hydrolic erosion.
- Study relationships between changing soil physical parameters and the variability of crop productivity in time.
- Develop infrastructure and appropriate irrigation management techniques.
- Quantify the benefits attributable to sustainable land/water use and the expected distribution of such benefits to different groups of society.
- Analyze conflict resolution for the rational use of land and water resources in mountain agroecosystems.

c. Commodity systems (production to utilization).

Activities under this research area include production systems such as crops and animals, agroforestry, and aquaculture, and their potential to increase income under sustainable natural resources management.

Research will attempt to:

- Understand the indigenous knowledge of current production systems in mountain agroecosystems. This will lead to the development of alternatives for the rational use of resources across mountain regions around the world.
- Characterize mountain crops and livestock products to assess their comparative advantage for developing markets and generating off-farm income.
- Assess the benefit/cost of technological interventions on-farm and reduced resource degradation in mountain watersheds.
- Study new crop alternatives across mountain regions that will allow producers to benefit, thus encouraging a commitment to resource conservation practices.
- Analyze the comparative advantage and limitations of community-based microenterprises to compete with larger producers.

Studies will result in technologies and development alternatives aimed at improving the sustainability of mountain farming and watershed systems, and at increasing the well-being of populations and the environment.

II - Policy Studies

Policy issues are commonly analyzed nationally and regionally. In the sustainable mountain development scenario, we must also provide local policy-makers with watershed and farm information. These leaders actually make key decisions on the management of land and production.

Research Theme I (natural resource base) will be the main source of relevant and timely data. In this manner, policy-makers will have at their disposal elements to improve decision-making processes for sustainable mountain development.

Research in this area will attempt to:

- Study the relationship of macro and sectoral policies and land use systems.
- Examine trends in rural poverty, migration, population, and their relationships to constraints imposed by policy and institutional arrangements to provide new income and employment opportunities for world mountain populations.
- Design and implement policies based on studies of benefits obtained by society at large due to improved resource use.
- Strengthen the capabilities of local governments for policy formulation and decision-making for improved resource use.
- Develop policy-related sustainability indicators.

Policies will be designed and implemented to encourage an equitable and rational use of natural resources by mountain populations, and the adoption of technologies that will improve sustainable agricultural systems.

III - Methodological Research

Methodological work will be adapted from the place of origin in one mountain area, such as the Andes, to an alternate one. FSR/E is a recent example of such a development.

The first effort has to concentrate on the marriage of research and development in agriculture, rarely practised with continuity. We also need to improve ways to measure the different processes related to sustainable agriculture and the techniques necessary to connect components of the natural resource base (e.g., land and water management, biodiversity, production systems) with policy studies. These could be of help in conflict resolution efforts.

These methodological developments include the application of a holistic approach integrating models with experimental field work and technology interventions. It has high requirements in accessibility and development of new, interdisciplinary data bases (e.g., GIS). Additional outputs will relate to information (seminars, publications, communication links for research planning, etc.), human resource development in critical issues of sustainable mountain development, and strengthening of national institutions.

Global Institutional Links

The approach proposed herein includes the selection of specific locations in world mountain areas as benchmark or heritage sites in each of the developing world's three important mountain ecologies. At these sites, a research team, interdisciplinary and participatory in nature, would make use of local and outside expertise in conjunction with mountain communities and a broad range of institutions. Research will focus on measurement of the dynamic characteristics of systems, modelling to establish priorities for monitoring and evaluating the impact of land use systems, maintenance of biodiversity, and the design and implementation of policies. The research work will seek intervention at the commodity level to maintain productivity gains and achieve sustainable mountain agriculture.

A Research Consortium for Global Mountain Development

We propose institutional mechanisms involving activities in each of the developing world's important mountain regions. For each of these there will be a convener.

The consortium will be open and participatory to compensate for an imbalance in resources and to give membership to all stakeholders willing to share costs and benefits. It will include a broad range of institutions--national (NGOs, universities, NARS) and international--to work together to overcome priority constraints. An advisory council will provide oversight and an executive committee shall be responsible for day-to-day programming and coordination. Several steps will be involved in establishing the consortium for implementing activities on Chapter 13 of UNCED Agenda 21 on sustainable mountain development. They include early involvement of diverse institutions, a strong participatory approach for priority setting, research planning, and sharing of responsibilities and procedures for monitoring.

At the global level, the collaborating mechanism will be a small research consortium concentrating on three mountain areas: the Andes, Himalayas, and Eastern Africa. Activities will involve methodologies, specific technology transfer, and information exchange.

For each mountain area, the corresponding convener will develop a particular collaborating mechanism. An example of an institutional link is the current Consortium for Sustainable Development for the Andean Ecoregion (CONDESAN), organized by CIP and IDRC, at the request of national institutions. It undertakes research and development activities in the Andes with the active involvement of several national and international institutions.

The proposed Consortium for Sustainable Mountain Development would include:

- International Potato Center (CIP), the CGIAR focal point for Sustainable Mountain Development in the Andean ecoregion, Eastern Africa, and Himalayas.
- CONDESAN: Andean mountain agroecosystems
- ICRAF: highlands of Eastern Africa, CGIAR focal point for combating deforestation
- ICIMOD: Mountain agroecosystems of the Hindu Kush-Himalayas
- IPGRI: CGIAR focal point for the Biodiversity Convention
- NARS, NGOs, universities, local governments in targeted mountain areas
- University of Wageningen, Holland
- University of Manitoba, Canada
- Swiss Development Cooperation
- IDRC, Canada
- FAO
- UNEP
- Other CGIAR centres.

Costs

The research team should include experienced international staff in the areas of natural resources economics, agricultural land and water use systems, animal production systems, genetic resources, rural anthropology, mountain agricultural production and farming systems, nutrient cycling, techniques such as modelling, GIS, etc.

To allocate resources for global links and field work over a period of 4 years, an estimated lump sum is USD 6 million. This will provide support to global activities and the three proposed mountain agroecosystems.

Funds requested should also be available for adequate support to a range of participating national and international institutions on a competitive grant support scheme. These will cover specific local research needs complementing the overall effort in mountain agroecosystems.

AGRICULTURAL AND WATER POLICY TO SUSTAIN THE RESOURCE BASE AND PRODUCTIVITY GROWTH IN FERTILE LANDS

Global Scope of the Problem

Estimates of annual global losses of agricultural land due to waterlogging and salinization range from 300,000 ha to 1.5 million ha with most of the waterlogging and salinization in irrigated croplands of high production potential. Estimates of the total area already affected by waterlogging and salinity but still under production are only slightly more consistent range from 20 to 46 million hectares. Although even the lower estimates indicate that degradation of fertile (mostly irrigated) land is a significant and growing problem, the exact degree of the problem, and the policy interventions to solve the problem are poorly understood. Knowledge is surprisingly sparse on the causes and policy solutions to waterlogging and salinity, the impact of degradation on productivity and income, and the reversibility of degradation.

Problems with waterlogging and salinity are compounded by excessive fertilizer and pesticide use, and inappropriate crop rotations. These problems are often caused by policies, such as subsidies to fertilizer, pesticide, and water, that encourage inefficient use beyond the environmentally and agronomically appropriate levels. An important example can be seen in irrigated Asian rice, where availability of free water has sustained a double or triple monocrop of rice with unbalanced or excessive fertilizer and pesticide use, causing degradation of the paddy micro environment and in turn reducing rice yield growth. Appropriate crop diversification out of rice in second and third planting seasons would reduce pest infestation, restore micronutrient balances, increase nutrient carrying capacity of the soil, and reduce water use and therefore salinity and waterlogging. However, farmers will continue to grow rice because it is profitable, and profitability is guaranteed as long as they do not have to pay for the large amounts of water required.

These problems are identified as key priorities within the Conservation and Management of Resources section of Agenda 21. The research proposed here cuts across two major subsections, Sustainable Agriculture and Rural Development, and Protecting and Managing Fresh Water. The focus on institutions and incentives described below are particularly relevant to the broad theme within the Sustainable Agriculture subsection of encouraging farmers to invest in long term solutions by giving them ownership and access to resources.

Researchable Themes

Resource degradation in fertile areas is fundamentally caused by inappropriate policies which provide incentives for farmers to manage resources in ways that are not socially beneficial. Other contributing factors to degradation are; lack of appropriate technologies; lack of information about resource damage; inadequate property rights over natural resources and associated externality problems; ineffective public institutions; and inappropriate government policies. Together, these factors can create incentives that make it profitable for farmers to degrade resources even though this is not in communal or national interests, or even in the long-term interests of farmers themselves.

Previous research has often handled these factors in piece-meal fashion; here we propose to look at them in integrated fashion by focusing on the institutions and incentives that govern resource allocation in fertile areas. The research would examine in integrated fashion how resource allocation policies affect input use, productivity, and sustainability of the land and water base in fertile areas. Because of the importance of water, and water-related degradation in these areas, the analysis will be centred on the interaction of agricultural policy with water resource institutions, incentives, and structures.

The broad research theme is to determine the impact on farm management, productivity, equity, and the environment of alternative agricultural input and output pricing policies and water resource allocation policies and mechanisms, including centralized administrative allocation, user-based allocation, and water-rights based market allocation; and to understand the impacts of these policies, The analysis will assess the relationships and possible trade-offs between the efficiency and productivity-enhancing impacts of alternative resource allocation systems and their environmental consequences. Environmental consequences examined will include waterlogging, salinization, fertilizer and pesticide pollution, groundwater recharge, groundwater mining, and degradation of water quality. Particular attention will be paid to how alternative policies and allocational methods affect farmer security and empowerment over resources, and how they affect long term farmer investments in resource sustainability.

The research will utilize a cross-country comparative analysis. Countries will be chosen so as to provide a wide variation in the degree of existing degradation of fertile land, levels of economic development. degree of water scarcity, and agroclimatic conditions. Research sites will be chosen to coincide with and support ecoregional initiatives of the CGIAR. Possible countries based on these stratifications would include China, Indonesia, Jordan, Malawi, Mexico, Morocco, Pakistan, Zimbabwe. The common

methodology described briefly below will be employed in each case to retain comparability across countries.

The methodology will have the following components: (a) analysis of the evolution of existing policies and systems of water resource allocation, with particular reference to how they have affected levels of agricultural intensification and resource degradation, relative water scarcity, and the technology base; (b) resource base assessment and analysis of macro-level allocation processes, c) analysis of the role of laws, contracts, different forms of property rights and institutions in alternative water resource allocation systems; (d) analysis of the impact of agricultural pricing policy, tax and subsidy policies, and water allocation mechanisms on farmer choice of cropping pattern, input use, productivity, and resource degradation using farm-level econometric analysis and formal modelling,

Anticipated Research Output and Impact

Research output will be disseminated via formal monographs, short policy briefs, and a series of workshops. The results of the analysis will be directly relevant to national governments and international donors for (a) choosing appropriate agricultural pricing and water resource allocation policies to maintain agricultural productivity growth and sustain the environment in fertile lands; (b) establishing priorities for reform of the institutions and incentives which affect water resource allocation, and in turn the choice of cropping patterns and input use; and (c) establishing an analytical framework to be utilized in future research on these issues. The latter goal would be achieved by development of practical integrated economic and resource planning models for evaluation of the impact of policies on environmental sustainability and agricultural productivity. These models will be institutionalized as tools for policy analysis in relevant institutions in the collaborating countries.

The chief long term beneficiaries will be farmers and consumers in the developing countries, as government policies are modified to provide the appropriate incentive structures and institutional support base to encourage farmers to adopt technologies, resource use patterns, and farming systems that conserve and rehabilitate land and water while increasing production and farm income.

Participating Institutions

Because of the importance to this analysis of cross-cutting policy issues, the lead institution would be IFPRI. Important collaborative roles would be played by IIMI, because of the interaction of policies with technology and irrigation management, with IFDC on fertilizer technology and policy issues, with IBSRAM on soil management, and by

the CG centres directly responsible for the ecoregions in countries selected for the analysis, particularly IRRI. Each country study would be undertaken in collaboration with NARs in those countries. The appropriate NARs would be selected as project development proceeded, and would include research institutions, resource management agencies and farmers' organizations.

Costs

Staffing and monetary resource requirements cannot be determined precisely until further project development is completed. However, to retain a genuine comparative basis, at least four country studies would be required. The estimated average cost of each country policy study, including all international and national resources, would be about USD 400,000 per year for four years, or USD 1.6 million per country. To undertake comparative policy analysis in eight countries would cost USD 3.2 million per year over four years.

Technical research will also be needed on selected topics, to be undertaken by IIMI, IFDC, and IBSRAM. This will require an additional USD 2 million per year for four years.

The total for all policy and technical research is estimated to be USD 5.2 million per year for four years.

GLOBAL LONG-TERM FORESTRY RESEARCH NETWORK

Introduction

The purpose of initiative is to establish a collaborative network of CGIAR, national and international forestry research institutions and NGOs to undertake sustained, long-term forest management and conservation research in a series of tropical forest sites. The main areas of proposed research include: developing technological options for increasing and sustaining forest productivity; developing management systems that maintain the integrity of tropical forest ecosystems; developing and testing new methodologies for biodiversity assessment; and monitoring the impact of various forest management options on biodiversity and climate change. In addition, a research programme on socioeconomic and policy issues will focus on improved understanding of incentives for encouraging local people's participation in forest conservation and management.

In line with the CGIAR's mandate, and in keeping with the CGIAR's commitment to contribute to implementation of the objectives of the Global Conventions on Biodiversity and Climate Change, special emphasis will be given to developing a research agenda aimed at the adoption of improved technologies and management practices that will promote the sustained well being of poorer people. Secondly, research on how improved forest conservation and management practices and government policies can contribute to the preservation of the global environmental benefits of forests will be emphasised. Particular attention will be given to the conservation of forest-based biodiversity and genetic resources and the carbon sequestration potential of natural forests.

Participating organizations

- Center for International Forestry Research (CIFOR),Indonesia

-Center for Tropical Forest Science, Smithsonian Institution (CTFS/STRI), Panama

-Tropenbos

-Cirad Foret

-Developing-country national research institutions and NGOs participating in the network

Project objectives

The development of a global network of long-term forestry research programmes and sites is aimed at promoting more effective development and dissemination of sustainable forest management systems for both local and global

benefit. The principal objectives of the network are as follows:

(1) Developing consensus among long-term forestry research programmes regarding priority issues requiring a coordinated research effort, and common methodologies that can be used to address them.

(2) Facilitating collaboration between long-term research programmes, including synthesis and dissemination of research results across sites and promotion of interdisciplinary research within sites.

(3) Linking forestry research to improved forestry policies and practices, particularly those concerning biodiversity assessment and conservation, the maintenance of natural forests as carbon sinks, improved management of natural forests, and the production and allocation of forest benefits to local and national economies.

(4) Providing financial, logistical and training support to national forest research institutions for sustained research and dissemination of results, working in close collaboration with ongoing multilateral and bilateral assistance agencies, including FAO and IUFRO.

Project rationale

Tropical forests are diminishing at a rate which threatens not only biodiversity and global climate stability, but the quality of life for a large portion of the Earth's population as well. Those at most immediate risk are the rural poor living on or near marginal forest lands, who depend on forests for a variety of products and services. As one facet of current attempts to contain tropical deforestation, sustainable systems of tropical forest management need to be developed that are biologically viable, socially equitable and economically useful.

Past efforts to design and disseminate such systems have been constrained by a lack of adequate knowledge concerning tropical forest composition and function, productivity, economic value and practical options for their improved management and conservation. This is partly attributable to a past failure of both national governments and assistance programmes to develop sustained forest management research that is well coordinated at an international level and capable of producing results that can be synthesised to derive generalisable options for forest management.

In response to these problems CIFOR, in cooperation with a number of national and international research organisations, held a meeting on long-term forestry research in Cisarua, Indonesia in November 1993. As a result of this meeting, and a subsequent meeting organised by CTFS/STRI in Panama in March 1994, participants agreed

unanimously on the need to improve coordination and collaboration between existing long-term forest research programmes and sites.

Network organization

Two major components of the network are proposed. Funding would be roughly divided between these two components, which would be designed so as to closely complement and interact with one another. The proposed components are:

(1) A core network of some 10-15 principal research sites representing a range of forest types and uses, in which methodological approaches will be developed and long-term monitoring systems put in place.

(2) The provision of essential networking services to a wide array of long-term research programmes and sites to facilitate collaboration on critical forestry research issues.

Core Sites Programme

The first component of the proposed project will focus on identifying and developing an estimated 10-15 core research sites representative of the major tropical forest ecosystems in Asia, Africa and Latin America. These sites will provide the focal points for CIFOR and its partners to develop methodologies and collaborative research programmes to address key forest management and conservation issues.

The major research activities to be undertaken under this component of the proposed project include the development, testing and dissemination of:

(1) Practical, rapid methods for assessing and monitoring biodiversity of the world's tropical forest resources and related forest productivity.

(2) Generalisable methods of forest valuation, including timber and non-timber products and environmental services.

(3) Tropical tree growth and regeneration information systems.

(4) Management practices that reduce the damage incurred during the harvesting of forest products, thereby ensuring the maintenance of the carbon sequestration potential of natural forests.

(5) Forestry systems that emphasise local people's participation in forest management, with particular attention to the flow of forest benefits to local households and economies.

(6) Methods of rehabilitating forest lands through such practices as assisted natural regeneration and joint forest management. Sites will be selected for wide geographic representation, with roughly equal numbers of sites in Asia, Africa and Latin America. The sites will be developed on a landscape scale to encompass a wide array of forest types and uses, including protected forest areas, production forest, buffer zones and extractive reserves, and degraded forest areas and their dependent communities, permitting interdisciplinary research on a variety of forestry issues at the same site.

The process of selecting the core research sites has only recently been initiated. Selection of an initial 3-6 sites will be carried out in 1995 through close consultation with national research institutions, conservation NGOs, the Global Environment Facility and other CGIAR centres. A subset of the initial core sites will constitute benchmark study areas for CIFOR-coordinated research on improved methods for biodiversity assessment. Additional sites will be selected in ensuing 2-3 years, with the total number and location of sites decided according to research priorities and within-country support.

Where possible, sites will be selected that coincide with existing long-term forestry research sites, including existing GEF sites and ICRAF's Alternative to Slash and Burn benchmark sites. Possible examples include Jambi, Indonesia, Huai Kha Khaeng, Thailand, and Noel Kempff Mercado National Park, Bolivia. In addition, the project will inherit and build on the considerable experience already gained at long-term forestry research sites established by national research institutions, sometimes in cooperation with specialised research programmes such as CTFS/STRI, Cirad Foret and Tropenbos. These sites, particularly those with potential for expansion into landscape sites, represent attractive locations for core research sites.

The backing and active participation of host-country government research institutions and NGOs will be stressed in the selection and development of core sites. Host-country institutional participation in site development, problem identification and the development of the research agenda will be stressed. CIFOR will not manage the sites directly; instead, the control and management of the core research sites will remain with the appropriate host-country institutions, in some cases with the continued support of international organisations under existing arrangements.

Funds devoted to this component would be applied to: (1) a one-time grant for infrastructure improvements and the expansion of the sites to encompass landscape scale programmes; and (2) the establishment of site endowments, with independent financial oversight, for site maintenance

and continued collection of base-line biophysical and socioeconomic data necessary for long-term research. In designing this programme component, close liaison will be maintained with similar initiatives that have already been launched in both tropical (e.g. ICRAF's Alternatives to Slash and Burn project) and temperate (e.g. the Canadian Model Forests Programme) forest regions.

Global Research Network

The second project component is designed to provide a number of logistical and financial services to improve research coordination and promote collaboration among a large array of existing long-term research programmes and sites. This network will include both multinational and developing-country NARS programmes and sites, with particular emphasis on building developing-country institutional capacity. The objectives of this component are:

(1) Developing consensus among existing long-term research programmes regarding common methodologies and minimum data sets needed to jointly address critical research issues.

(2) Establishing mechanisms for sharing data among research programmes and facilitating synthesis of research results.

(3) Promoting adaptive research to apply and test the replicability of the methodologies and management practices developed in the core sites programme.

(4) Exchanging technical expertise between programmes and developing interdisciplinary capability within programmes.

(5) Strengthening the administration and management of research sites and programmes.

(6) Disseminating research results through highly-focussed policy papers, workshops and demonstration and training programmes.

This component of the project will be accomplished through the establishment of regional coordinating functions located at existing research institutions within Asia, Africa and Latin America, and a global coordinating function, probably located at CIFOR. Network members will be linked electronically through internet, and by means of periodic reports, publications and workshops. For each of the above-named services, granting mechanisms will be established for the disbursement of funds to support collaboration between programmes. Grants will focus on, but not be limited to, the research topics outlined in the above section dealing with the core sites, and will include review and financial oversight by a consortium of independent scientists and network members.

Project benefits

There are substantial benefits to be gained from the development of long-term forestry research programmes and sites. Principal among these are:
(1) An opportunity to focus a significant portion of the tropical forest research community on priority forest issues.

(2) An ability to conduct similar types of research, using standardised methodologies, in a variety of tropical forest sites worldwide (between-site synergy). This would greatly facilitate the development and testing of generalised principles concerning forest function and management.

(3) An ability to conduct interdisciplinary research on the same sites, drawing on different strengths of various research institutions to develop holistic models of forest management that link biophysical and socioeconomic parameters (within-site synergy).

(4) Substantial capacity building in developing country research institutions through collaborative research, exchange of personnel, and demonstration and training activities.

As envisaged, a global network of forestry research programmes and sites would provide a significant increase in research efficiency and effectiveness over the current situation. Firstly, the network would greatly increase the *cost-effectiveness* of forestry research through a consolidation of effort and harmonization of methodologies. Secondly, it would increase the *effort-effectiveness* of individual researchers, particularly in the developing countries, by providing opportunities for collaboration and sharing of expertise among programmes. Thirdly, the network would increase the time-effectiveness of tropical forestry research by greatly decreasing the time necessary for results to be generated and translated into policy and management recommendations.

Complementarity with other CGIAR initiatives

Given that many of the underlying causes of deforestation and poor forest management are attributable to inappropriate land tenure, macroeconomic and other policies, biological research on forest ecosystems needs to be closely linked to forest policy research aimed at correcting policy distortions and creating effective incentive for local people's participation. Past research in this area has been weak. Despite widespread recognition of the key role that local communities could play in contributing to sustainable forest management, there has been little systematic research that has quantified the impact of alternative institutional approaches to forest

conservation and management on people's welfare, on forest productivity or on the environment.

In designing the proposed long-term forest research sites programme, CIFOR took into account the conclusions and recommendations of a series of CGIAR-sponsored forest Policy Workshops which had provided an opportunity for national forestry researchers, policy leaders and NGOs to identify high priority policy research issues that could also benefit from CGIAR support. A parallel programme of socioeconomic and biological aspects of devolution of forest management to local people. This research will be conducted in collaboration with other CGIAR centres, national research institutions and NGOs participating in the proposed network, with much of the field work done at the core research sites.

Another major ongoing CGIAR-led initiative, ICRAF's Global Slash and Burn project, is already addressing technological options for more sustainable farming systems for encroached forest lands and, in collaboration with CIFOR and IFPRI, the underlying causes of deforestation and policy options for its containment. Conservation of the germplasm of important forest crops is a major concern of IPGRI, which is spearheading a parallel effort concerned with developing improved methodologies for in-situ conservation of forest genetic resources. the proposed forestry research network is designed to complement these programmes, and CIFOR and its partners intend to work closely with the other CGIAR centres to secure a coordinated CGIAR effort to mitigate tropical deforestation and improve human welfare.

Funding requirements

During the current CGIAR planning period (1994-1998), first approximations suggest expenditures in the order of USD 3-4 million. For the longer term program (8-10 years), this might rise to total of USD 12 million.

THE BIODIVERSITY INITIATIVE

Strengthening the scientific basis of in situ conservation of crops, livestock, fish and forest genetic resources

Global scope of the problem

Despite mounting efforts over the last 20 years, the loss of diversity of crop, livestock, forest and fish genetic resources has continued. The world's rich diversity of traditional varieties and breeds, and of useful wild species, must be protected if it is to fulfil its potential as a fundamental resource for sustaining and improving future production.

Much has already been achieved, particularly in the ex situ conservation of crop genetic resources. The CGIAR Centres have contributed significantly to global efforts to secure the safety of these resources, maintaining more than 500,000 accessions in their genebanks. However, much valuable genetic diversity remains vulnerable, and it is clear that ex situ conservation on its own is insufficient.

The Convention on Biological Diversity states that countries have a responsibility to conserve their biological resources both in situ and ex situ. Agenda 21 identifies a range of activities required to achieve this, including the development of integrated national conservation strategies based on a knowledge of the resources present in a country. It also recognizes in situ conservation as a key component of strategies for conserving traditional varieties of plants and animals as well as for useful forest and aquatic resources.

While the importance of conserving natural ecosystems is well established, the use of in situ approaches for agricultural systems is relatively new, and follows from the growing recognition of the value of traditional varieties of plants and animals for sustainable development. In situ conservation of agricultural species is dynamic, permitting their continued evolution and adaptation through competition, hybridization, natural and conscious selection and exchange of material between farms, communities and regions.

Research issues and the role of CGIAR

While significant advances have been made in developing in situ conservation strategies, major knowledge gaps continue to limit their effectiveness. Procedures for locating populations, for determining minimum population sizes, and for assessing the importance of demographic and genetic stochasticity need to be improved. Baseline studies on the extent and distribution of genetic diversity, and on species biology and ecology are also required.

The in situ conservation of wild relatives of agricultural species presents further problems. For example, the choice of target population must take into account the need to conserve maximum intraspecific genetic diversity. In addition, the use of wild species in agricultural improvement often depends upon specific adaptive characters which may not be present in areas of maximum genetic diversity.

In situ conservation of agricultural species raises additional issues such as minimum viable population sizes, the importance of neighbourhood size, and the effect of connecting relatively small and isolated populations through farmer exchanges. Account must be taken of the fact that farmers choose what to retain, and apply selection pressures to their populations. A new and rather different approach to in situ conservation is required, based on conservation biology, population genetics, agronomy and genetic resources knowledge, within the context of specific socio-economic and cultural circumstances.

Limitations to our current knowledge pose considerable constraints in planning and executing effective in situ conservation actions. Despite the high level of commitment, (eg. by the GEF-funded projects in Turkey and Ethiopia, by international organizations such as FAO, UNESCO, IUCN and WWF, and by many national organizations), important research issues remain to be addressed. The CGIAR is well placed, by virtue of its scientific focus and established experience in many aspects of genetic resources conservation, to develop an integrated initiative to address key issues such as those listed above. It is also well placed to explore critical policy issues, and can play an important role in information management.

Research project description

Approach

The CGIAR Biodiversity Initiative aims to create a framework for an integrated approach to biodiversity conservation within the CGIAR. Several Centres are already involved in independent initiatives, and the creation of a framework for promoting complementarity is urgently required. Such a framework would also help to ensure that important research issues are not overlooked and that there are effective links to other relevant programmes and organizations.

The Biodiversity Initiative will allow individual CG Centres and groups of Centres, working with relevant local, national and international partner organizations, to contribute in areas of their specific expertise. The multidisciplinary nature of work on in situ conservation

will be recognized as will the need to ensure active participation of local communities from the outset.

The CGIAR contribution is likely to have greatest impact in four main areas: the development of the methods and techniques for more effective in situ conservation; the creation (with national programmes) of sites for long-term research; the training of individuals involved in biodiversity conservation; and support to national programmes on policy and management issues. The Initiative should also lead to enhanced public awareness of conservation issues, and the role that biodiversity can play in the development of sustainable production systems.

Organization

The Inter Centre Working Group on Genetic Resources will provide overall coordination of the CGIAR Biodiversity Initiative. Broad strategic directions will be addressed and full account taken of the work of other organizations. The Initiative will comprise a number of inter-related sub-projects covering specific topics and regions for which common approaches are needed. Separate Management Teams for each sub-project will be constituted to include representatives of the major participating institutions and donors. It is expected that sub-projects will include:

- In situ conservation of forest genetic resources. This topic has already been the subject of intensive discussions involving CIFOR, ICRAF and IPGRI and other partners, particularly FAO and several national programmes. It is likely to also involve IFPRI in the future.

- Conservation of the wild relatives of crops. A number of CGIAR Centres (e.g. CIAT, CIP, ICARDA, IPGRI and IRRI) have already initiated valuable research on the conservation of wild crop relatives, including studies on species distribution and relationships, and ecogeographic surveys of genetic diversity. ICARDA, for example, is developing a Consortium with national programmes and other relevant institutions to address some of these issues in a more integrated way.

- Strengthening the scientific basis of on-farm conservation of crop and agroforestry diversity. A programme of work which expands existing activities in this area is currently under development in IPGRI. CIP and IRRI already have work in progress, and ICARDA's Consortium initiative will also address issues relevant to this topic. Further initiatives are under discussion among several other centres. Special account will be taken of the links at the farm and community level between conservation

and development, taking into account the needs of farmers.

- On-farm conservation of animal genetic resources. With the creation of ILRI, and the identification animal genetic resources conservation as a priority research area, it is anticipated that this topic will receive greater attention in the future from the CGIAR. Although it is premature to plan a detailed programme of activities, one possible avenue to explore is the development of integrated crop livestock on-farm conservation and management systems.

  Conservation of fish species. ICLARM has identified a programme and expects to take a leading role in development of a component of work on useful fish species.

In addition the above sub-project areas, the Biodiversity Initiative will support studies on biodiversity within the context of other CGIAR initiatives (e.g. Slash and Burn and the Highlands initiatives).

Content

The development of improved methods and techniques is likely to be a common feature of all sub-projects. Because of commonalities among many of the research topics, coordination will be essential to optimize the use of resources.

Areas in which the Biodiversity Initiative is likely to make a major contribution include:

- development of improved methods for locating target species and populations for the conservation of forest species, crop relatives and fish species.

- development of methods for determining the extent of diversity (inter- and intra-specific) in target areas and populations. This will include the development and use of molecular methods and improved ways for integrating molecular data with data from other sources.

- gathering baseline information on relevant aspects of ecology and population biology.

- analysis of genetic diversity, both in ex situ collections and that remaining in the wild and on farm, to help define priorities for conservation programmes and to promote a greater use of genetic diversity.

One approach to be adopted is the identification of sites for long-term research (living laboratories or heritage sites). Such sites will provide conservationists an invaluable opportunity for studies on such topics as diversity distribution in populations, the effect of different management strategies, and methods for monitoring population survival and evolution. CG Centres are well placed to support the development of such sites in collaboration with national programmes, and to assist in providing the necessary infrastructure for their effective operation and use. They would operate both as field research sites and as centres for training.

Training will be a major component of all sub-projects, and the development of a Training Consortium on In Situ Conservation might constitute a separate sub-project area. The CG Centres can help ensure that those concerned with nature conservation are aware of the issues of conserving useful plant and animal genetic diversity, and that plant and animal breeders and genetic resources workers become familiar with in situ conservation theories and practice.

Socio-economic studies will be undertaken on the inter-relationships between agricultural production at the local and national level and biodiversity conservation demands. Such studies will have significant implications for national policies as well as for the structure and organization of national research systems. IFPRI and ISNAR are expected to take a lead in these studies which are likely to be of significance in all of the sub-projects. It is anticipated that the promotion of public awareness of the need for expanding efforts to conserve biodiversity will also be built into many of the individual components of the Initiative.

Participating institutions

All centres are expected to be involved in the Biodiversity Initiative in one way or another. IPGRI, CIFOR and many of the Centres with crop mandates are already beginning to become involved with in situ conservation. ICRAF, the new animal centre, ICLARM, IFPRI and ISNAR are all considering ways in which their work can take account of concerns for biodiversity.

The work will require extremely close collaboration with national programmes, particularly with those with a significant commitment to in situ conservation and which would have an interest in the identification of living laboratory sites.

Collaboration with other research institutes in developed and developing countries and with NGOs, Universities and community groups will be essential.

Next Steps

The following steps will be undertaken in the further development of the proposed Biodiversity Initiative:

- Discussions among the ICWG-GR (using BIO-REM) to further develop approaches and ideas.

- Identification of key partners and further development of initial contacts

- Development of the overall framework of the Initiative and of the major components of each sub-project.

- A series of workshops with partners and donors to formulate sub-projects

- Submission of sub-projects and components of sub-projects to donors.

Costs

The Initiative will comprise many components. At a conservative estimate, if the CGIAR is to make a significant contribution to the science of biodiversity conservation, additional resources of not less than USD10 million per year will be required.

INTEGRATED PEST MANAGEMENT INITIATIVE

Global scope of the problem

Crop losses in tropical production systems due to attacks by pests and diseases are commonly large (30 - 100%). Large-scale use of chemical control agents, when available, carries obvious and hidden environmental costs, and may involve significant health risks, both during application and through accumulation in the food chain. For smallholder agriculture the physical and economic infrastructure required to secure production through general use of chemical control agents is often absent. This adds uncertainty and risk to vulnerable production systems, and may induce human starvation and famine.

Recent advances in integrated pest management (IPM) techniques explored in the CGIAR crop research centres indicate that IPM has considerable potential beyond the mandate crops of the IARCs. Complete production systems may be improved thus increasing both yield and food security with environmentally more benign techniques, and with smaller direct health risks.

IPM is recognized in UNCED Agenda 21 as a key component of environmentally sustainable agriculture. The CGIAR system has an unexploited potential from its work with single crops and selected production system. A lack of a coherent CGIAR policy has constrained the ability of the CG system to fully contribute to the realization of Agenda 21 objectives. The CGIAR should develop and adopt a distinct, proactive policy on IPM, affirming the value of this approach to environmentally-sustainable agricultural development, and should extend collaboration centres and outside partners

Researchable themes

1.1 Characterization of functional agrobiodiversity in support of Food Production Systems

Rationale

The CGIAR presently holds a unique resource and knowledge base on genetic diversity of tropical food crops. This is an important resource for IPM in the context of host plant resistance, but it is only part of what is required to use local biodiversity effectively in IPM systems. There is also a need for a better understanding of the genetic diversity of pests and diseases (e.g. to optimize resistance breeding and identify pesticide resistance) and of natural enemies, which are very poorly characterized for most tropical crop systems.

Objective

To improve development of IPM methods through better understanding and utilization of the genetic diversity of plants, pests and natural enemies in agroecosystems and the natural ecosystems with which they interface.

Outputs

a) Methodology for utilization by NARS in
*characterization of important plant genetic diversity in crops and wild species

*identification and characterization of natural enemies of pests, weeds and diseases

*diagnosis and evaluation of difficult race variation in plant diseases and pests

*identification of insecticide resistant strains

b) Inventories and descriptions of functional agrobiodiversity for particular crops and agroecological zones, and associated identification and information management systems.

CG Institutions and partners

All, with complementarily to CGIAR-UNCED germplasm conservation initiative.

NARS and international institutions with expertise in diagnostic systems, BioNET partners and loops for biosystematic support.

Costs

USD 4 million over 4 years

Client driven research for IPM implementation

Rationale

Selection of research priorities needs to be informed by close interaction with projects concerned with IPM implementation to ensure they are responsive to user needs. Methodologies to secure such interaction are poorly developed and few effective links are currently in place. The approach would be to appraise current research thrusts and identify new areas of work in discussion with partner organizations, in particular those interfacing directly with farmers. An agreed research agenda would then be defined with a set of agreed outputs. Their uptake and impact would then be jointly monitored and evaluated by participating groups.

Objective

To define research priorities the context of the IPM implementation process through the joint articulation of research needs with partners.

Outputs

°Methodologies and procedures for the joint identification of research priorities responsive to the perceived needs of end users

°Enhanced interaction between CG institutes and organizations involved in IPM implementation

°Research outputs in the form of new or improved knowledge, technologies or strategies for IPM implementation in selected systems

CG institutes involved

The initiative should be led by those with an eco-regional focus (IITA,CIAT,ICRISAT,IRRI)

Partner Institutions

NGOs (CARE, FAO), other International Organizations

Time Frame

Phase 1: (yr 1) Develop systems for identification of consensus on research priorities and apply to selected projects (one per region?)
Phase 2: (yr 2-3) Conduct joint research program
Phase 3: (yr 4-5) Validate outputs and develop techniques for incorporation, uptake and impact evaluation

Notional Cost

USD 4 million over 5 years.

GLOBAL DIGITAL DATA SETS FOR USE IN GEOGRAPHIC INFORMATION SYSTEMS

Many of the activities above require global or near-global data sets on natural science variables, land use and socio-economic data. Such data sets are currently fragmentary and poorly standardized, with uneven quality control and up-dating mechanisms.

Similarly, in the analysis and presentation of spatial data sets, techniques available within many geographic information systems have proved to be powerful tools, provided the output from the analysis of the data sets can be sufficiently standardized to ensure compatibility with the most commonly used systems.

The Task Force reports that a separate initiative is now underway between the CGIAR centres (lead centre: ILRAD) and UNEP's GRID system for the construction of minimum sets of essential variables, with in-built standardization and quality assurance procedures. This GIS initiative is seeking separate funding and requests are with potential donors. A total of approx. USD 1.2 million is required for the first phase.

The Task Force reiterates its earlier statements that the availability of and easy access to such data sets will be of great importance to research planning, execution and presentation of conclusions from undertakings like those listed above.

The Task Force stresses that its concerns include data sets only, and not the actual GIS software/hardware systems subsequently used for processing the data. The choice of GIS remains within the organizations wishing to use the standardized data sets.

IV. **FUNDING AND ORGANIZATIONAL MATTERS**

Following the early work of the Working Group/Task Force on CGIAR Follow-up to Agenda 21, the CGIAR centres have responded by forming consortia within the CGIAR system on the broad topics suggested in the earlier phases of the follow-up work. This consortia also include non-associated centres, NARS, regional organizations and NGOs.

The current report of the Task Force therefore reflects these initiatives. The thrusts have been developed through careful analysis of Agenda 21 ambitions and requests on the international research community. In particular, the thrusts reflect issues covered by the conventions on Climate Change and Biological Diversity, with additional reference to the expected forthcoming Desertification Convention.

The CGIAR initiatives foresee a number of interested funding agencies, including the Global Environment Facility, multilateral organizations with the UN and development bank systems, and bilateral donors. Where donors wish to form funding consortia, UNEP has indicated its willingness to consider requests for making earmarked trust fund arrangements.

With a specified CGIAR centre taking a lead role for each of the thrusts, the organization of each activity will reflect on the wishes of the participating organizations and agencies. Most of the activities above foresee the use of international steering committees with distinguished members from the global community.